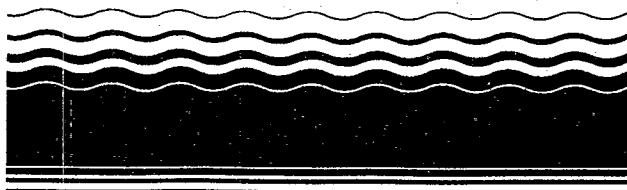




SITE

**SUPERFUND INNOVATIVE
TECHNOLOGY EVALUATION**



Demonstration Bulletin

AquaDetox®/SVE System

AWD Technologies, Inc.

Technology Description: The AWD technology simultaneously treats groundwater and soil-gas contaminated with volatile organic compounds (VOC), such as trichloroethylene (TCE) and tetrachloroethylene (PCE). This technology integrates two processes: (1) AquaDetox®, a moderate vacuum (pressure about 50 mm Hg or greater) stream stripping tower that treats contaminated groundwater, and (2) a soil vapor extraction (SVE) system that removes contaminated soil-gas for subsequent treatment with granular activated carbon (GAC) beds. The two technologies are integrated into a closed-loop system, providing simultaneous remediation of contaminated groundwater and soil-gas with no air emissions. The major components of the integrated AquaDetox®/SVE system are shown in Figure 1.

AquaDetox® is a high-efficiency, countercurrent stripping technology developed by Dow Chemical Company. Stripping is commonly defined as a process that removes dissolved volatile compounds from water. A carrier gas, such as air or steam, is purged through the contaminated water, with the volatile components being transferred from the water into the gas phase. According to the developer, the AquaDetox® technology can be used to remove a wide variety of volatile compounds, as well as many compounds that are normally considered "non-strippable" (i.e., those with boiling points in excess of 200°C).

SVE is a technology commonly applied for the in-situ removal of VOCs from soil. A vacuum is applied to vadose zone extraction wells to induce air flow within the soil toward the wells. The air acts as a stripping medium that volatilizes the VOCs in the soil. Soil-gas from the extraction wells is typically treated in GAC beds before release to the atmosphere. Alternatively, the treated soil-gas can be reinjected in the soil to control the direction of air flow in the soil.

The AquaDetox® and SVE systems are connected in a closed loop. Non-condensable vapors from the AquaDetox® system are combined with vapors from the SVE compressor and treated using two GAC beds in series. The GAC beds are regenerated periodically using steam. The regeneration steam removes the adsorbed contamination from the GAC as it moves upward through the bed. It is then condensed and sent to the AquaDetox® tower for treatment.

Recovered organics are collected in an on-site storage tank and are periodically trucked to an off-site facility for recycling.

Waste Applicability: The AWD technology is designed to treat groundwater and soil contaminated with volatile and semi-volatile organic compounds. Desirable soil characteristics for successful soil vapor extraction are high permeability, large grain size, and a low moisture content. However, for soils with even moderate permeability (permeability range about 10^{-3} to 10^{-5} cm/sec), sufficient air flow for removal of contaminants is possible.

Demonstration Results: The AWD technology was demonstrated over a 2-week period in September 1990 at the Lockheed Aeronautical Systems, Inc. facility in Burbank, California. The testing plan consisted of 21 test runs performed under varying operating conditions. The test runs were grouped into six phases. Phase 1 test runs were performed at AWD-specified operating conditions (tower pressure at 105 mm Hg, steam flow rate at 3,800 lb/hr, and groundwater flow rate at 900 gpm). The steam flow rate was varied in Phase 2 test runs. Steam flow rates and tower pressures were varied simultaneously in Phases 3 and 4. The groundwater flow rate was varied in Phase 5 test runs. Phase 6 involved the SVE system in which the GAC bed regeneration frequency was varied.

Based on the analytical results and observations from the AWD SITE demonstration, the following conclusions were made about the technology's effectiveness and cost.

- The AWD technology can successfully treat groundwater and soil-gas contaminated with VOCs.
- The efficiencies were in the 99.92 to 99.99 percent range for removal of VOCs from contaminated groundwater. VOC removal efficiencies for soil-gas ranged from 98.0 to 99.9 percent when the GAC beds were regenerated according to the SWD-specified frequency (8-hour shifts). VOC removal efficiencies dropped to as low as 93.4 percent when the GAC beds were regenerated less frequently.
- The AWD technology produced effluent groundwater that complied with regulatory discharge requirements for TCE and PCE (5 µg/L for each compound) at the Lockheed site throughout the SITE demonstration. In addition, routine sampling by Lockheed has shown that the effluent groundwater has been in compliance with the regulator requirements throughout the 2-year operation of the system with no reported violations.
- The GAC beds effectively removed VOCs from contaminated soil-gas even after 24 hours of continuous operation without steam regeneration.

- The AquaDetox® system proved highly effective in removing VOCs such as TCE and PCE (boiling points up to about 120°C) from contaminated groundwater. The system should also be effective for less volatile organics (boiling points in excess of 200°C according to the developer). However, because higher boiling point organics were not present in the groundwater treated during the AWD SITE demonstration, the system's effectiveness in removing this type of contamination could not be evaluated. Water containing such organics should be subjected to a treatability study.
- The system's steam consumption dropped with decreasing tower pressures. During the demonstration, the system proved more efficient at lower operating tower pressures.
- The system has been operating successfully for over 2 years at the Lockheed site. During this time period, the system has been operational for 95 percent of the time, with 5 percent downtime due to scheduled or non-scheduled repairs.
- The AWD system is estimated to cost approximately \$3.2, \$4.3, and \$5.8 million for the 500-, 1,000-, and 3,000-gpm systems,

respectively. The total annual operation and maintenance costs are approximately \$410,000, \$630,000, and \$1,500,000 for the 500-, 1,000-, and 3,000-gpm systems, respectively.

A Technology Evaluation Report and an Applications Analysis Report describing the complete demonstration will be available in the Summer of 1991.

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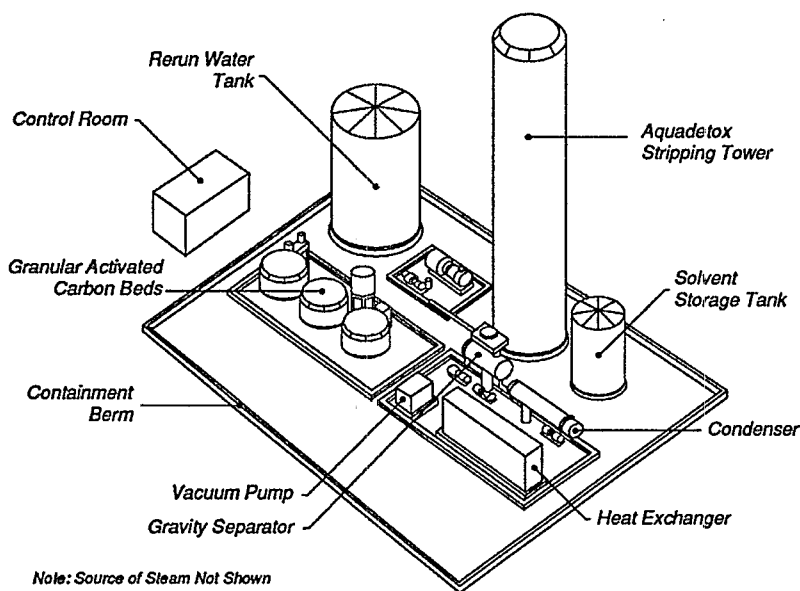


Figure 1. Isometric View of the AWD Integrated AquaDetox®/SVE System.

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